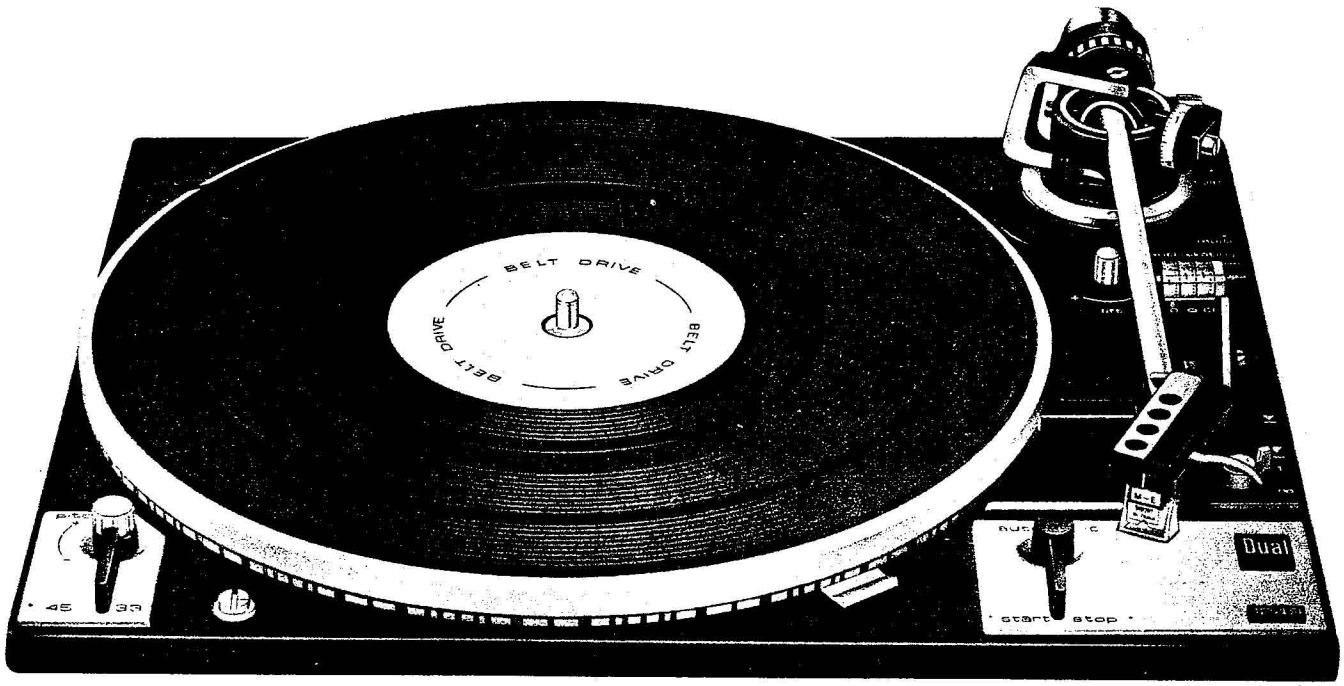
Dual 1249

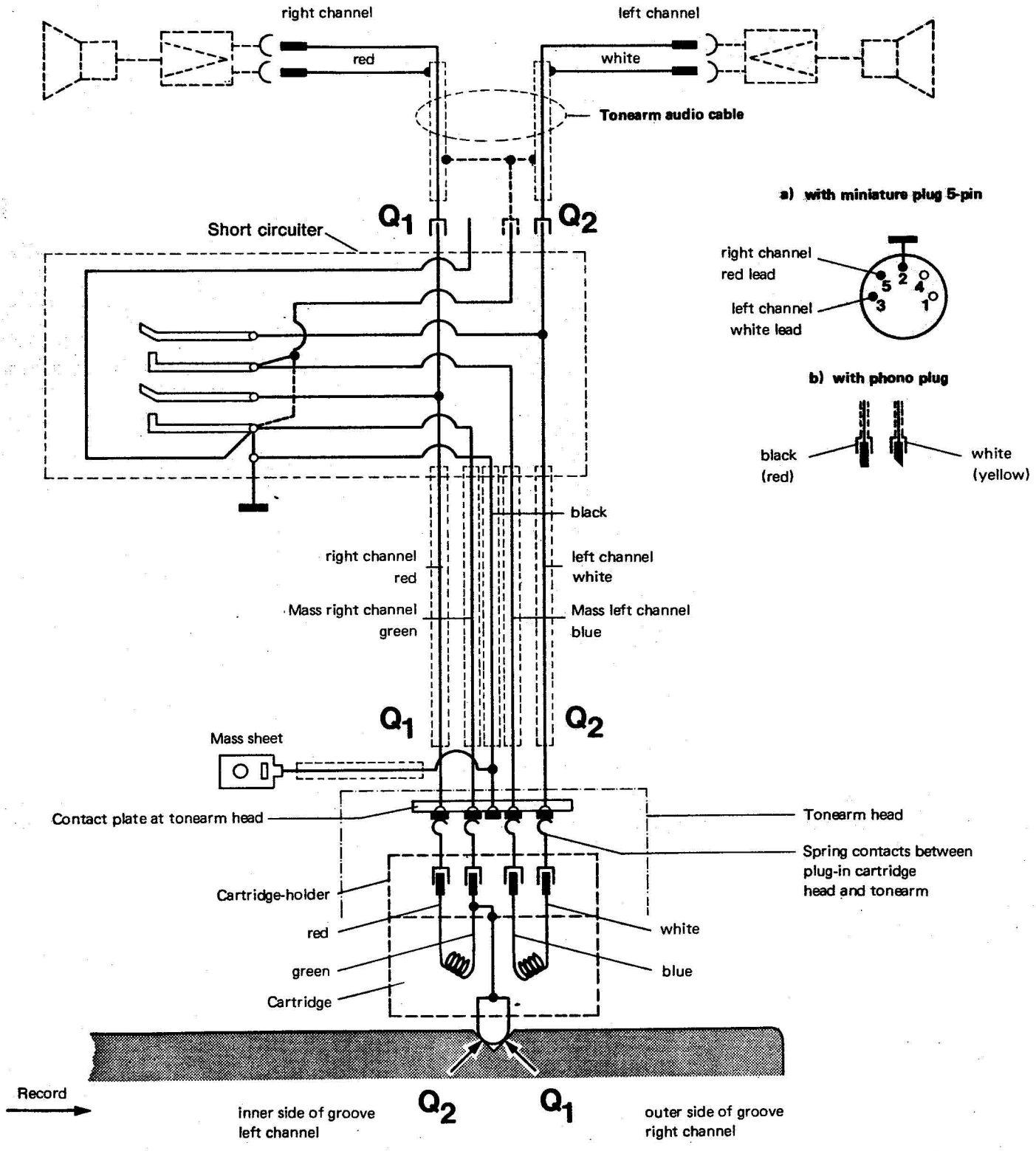
May 1975 Edition



Service Manual

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

Fig. 1 Pick-up Connection Diagram



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Specification

Current	AC 50 or 60 Hz, Changeable by changing motor pulley
Line Voltage	110 – 130 V or 220 – 240 V, switchable
Drive	Dual 8-pole synchronous motor: flat belt for flywheel drive
Power consumption	approx. 10 Watts
Starting Time	(to reach nominal speed) approx. 2 seconds at 33 1/3 rpm
Power consumption	at 220 V, 50 Hz: approx. 75 mA at 117 V, 60 Hz: approx. 140 mA
Platter Speeds	Non-magnetic, dynamically balanced, detachable, 1.3 kg, 305 mm ϕ, total speed load of drive system (Platter with flywheel drive) 2,1 kg
Platter speeds	33 1/3 and 45 rpm, Automatic tonearm set-down coupled with speed adjustment
Pitch Control Variation	Adjustment range of approx. 1 semitone (approx. 6 %) at both platter speeds
Illuminated strobe sensitivity for speed deviation of 0.1 %	3 bars/min at 50 cps 3.6 bars/min at 60 cps
Speed Control	with illuminated stroboscope for platter speeds 33 1/3 and 45 rpm
Total Wow and Flutter	According to DIN 45 507 (German Industry Standard) $< \pm 0.08$ %
Rumble (according to DIN 45 500)	Unweighted > 42 dB Weighted > 63 dB
Tonearm	Torsion-resistant tubular aluminum tonearm in four-point gimbal
Effective Length of Tonearm	222 mm
Offset Angle	25° 20'
Tangential Tracking Error	0.16°/cm
Tonearm Bearing Friction (related to stylus tip)	Vertical < 0.07 mN (0.007 p) Horizontal < 0.16 mN (0.016 p)
Stylus pressure	from 0 - 30 mN (0 - 3 g) infinitely variable with 1 mN (1/10 g) calibrations from 0 - 15 mN (0 - 1.5 g) operable from 2.5 mN (0.25 g) stylus pressure up
Cartridge Holder	Removable, accepting any cartridges with 1/2" mounting and a weight from 4.5 to 10 g (including mounting hardware)
Adjustable Overhang	5 mm
Weight	approx. 7,6 kg For dimensions and cutout refer to Installation Instructions

Fig. 2 Motor and Drive

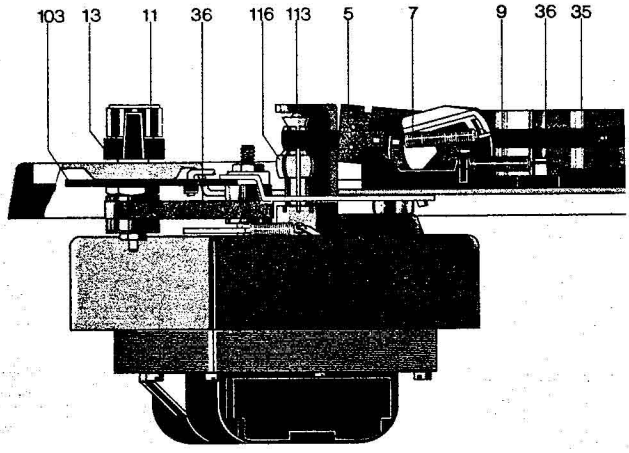


Fig. 3

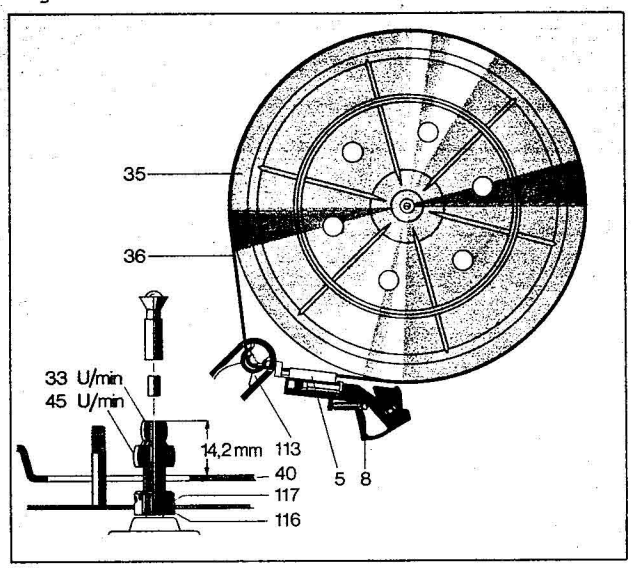
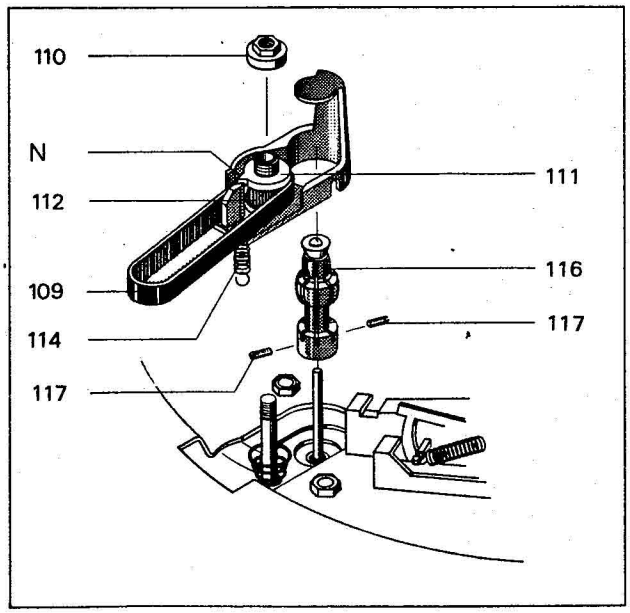


Fig. 4



Motor and Drive

The turntable platter and the changing mechanism are driven by an eight-pole, synchronous motor suspended by radially located elastic mounts and having a very small stray magnetic field as well as little vibration.

The speed of the motor is a function of line voltage, temperature and load variations. Speed is dependent on and proportional to line frequency. The motor is adapted to 50 or 60 Hz power line frequencies by the correct choice of motor pulley.

Pulley for 50 Hz Part.-No. 234 453
Pulley for 60 Hz Part.-No. 234 454

The drive is linked to a flywheel rotor beneath the platter by a precision-ground belt (36). When replacing the flat belt (36) be sure that the precision-ground surface of the belt (dull finish) closely contacts pulley (116) and the flywheel rotor.

Platter speeds of 33 1/3 and 45 rpm are adjusted by linking the flat belt (36) to the corresponding step of the drive pulley (116) (Fig. 3).

Corresponding to the actuation of the speed selector (13) the changeover lever is brought to the appropriate position of nominal speeds (33 or 45 rpm) via lever (102) and spring lever. When the unit is electrically shut off the changeover lever is blocked by locking bar (8). Consequently, the speed is only preselected. After switching on the unit and turning the platter (34) the pawl (8) disengages the changeover lever, thus guiding the flat belt to appropriate step of the pulley (116).

Replacement of Motor Pulley

1. Remove flat belt (36) from motor pulley (116) toothed belt from toothed belt pulley II (105).
2. Disengage tension spring (114) at shield (121).
3. Undo adjusting nut (110).
4. Pull-off the counter bearing assembly consisting of the counter bearing, toothed belt pulley I (112), stop disk (111) and toothed belt (109).

   Attention:

   Do not remove stop disk (111) from toothed belt pulley I. For correct adjustment of stop disk proceed as follows:

   Turn toothed belt pulley I (112) with toothed belt (36) counterclockwise until it stops at the counter bearing (113). Then turn quarter to half turn clockwise. Place stop disk (111) such that the nose (N) touches the stop as shown in Fig. 4.
5. Loosen set screws (117) and remove motor pulley (116).
6. Place complete replacement motor pulley on motor axle. Remove conical sleeve. Be careful with the interior distance bushing. Adjust motor pulley vertically (see Fig. 1) and tighten set screws (117) uniformly. Place conical sleeve into the motor pulley (116).
7. Mount the complete bearing assembly, and attach flat belt (36), toothed belt (109) and tension spring. Mount adjusting nut (110).

8. Setting of nominal speed
   To bring stop disk into center position turn adjustment knob correspondingly. (The nose of the stop disk should show to the motor pulley center).
   Adjust nominal speed by turning adjusting nut (110) counterclockwise thus the speed is reduced. When turning it clockwise the speed is increased.

Stroboscope

Accurate setting of the platter speed 33 1/3 can be checked during play with the aid of the stroboscope device.

When the platter (34) is rotating at exactly 33 1/3 the lines of the stroboscope appear to stand still. If the lines of the stroboscope move in the direction of rotation of the platter, the platter speed is too high. If the lines move backwards, the platter is rotating more slowly than the nominal speed.

Adjustment is carried out with the "pitch" knob (11).

The turntable platter (34) is fitted with stroboscope markings for 50 and 60 Hz, therefore a re-arranging of the stroboscope is not necessary if frequency changes. After removing the housing top (258) the glow lamp (260) can be changed.

Trouble

After switching the unit on the glow lamp (260) of the stroboscope does not come on.

Cause

a) Glow lamp (260) defective
b) Power supply interrupted

Remedy

a) Renew glow lamp (260). In the case of glow lamps with red spot, ensure that the red spot (anode) faces the C 1 capacitor.

b) Check connections at power pack, check components.

Fig. 5 Motor field connection

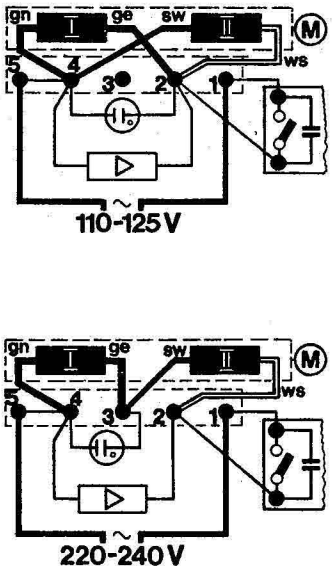


Fig. 6

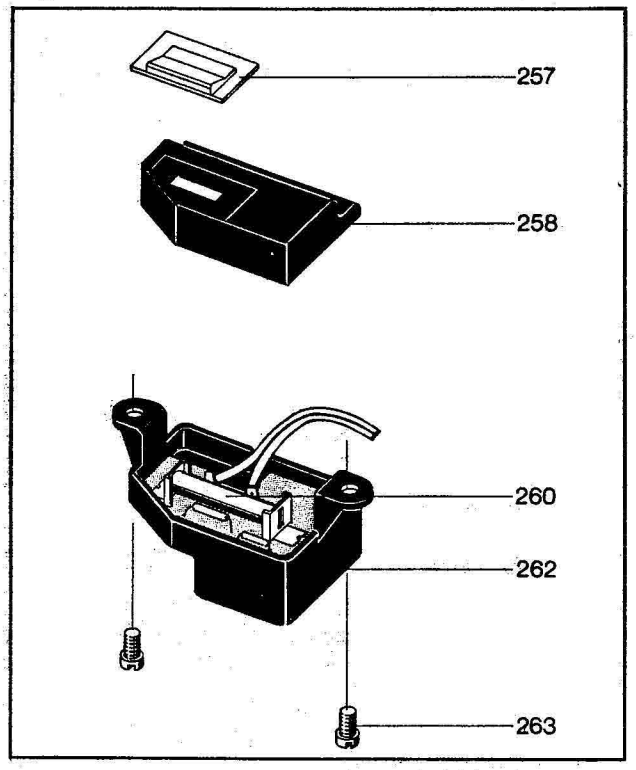


Fig. 7 Stroboscope (wiring diagram)

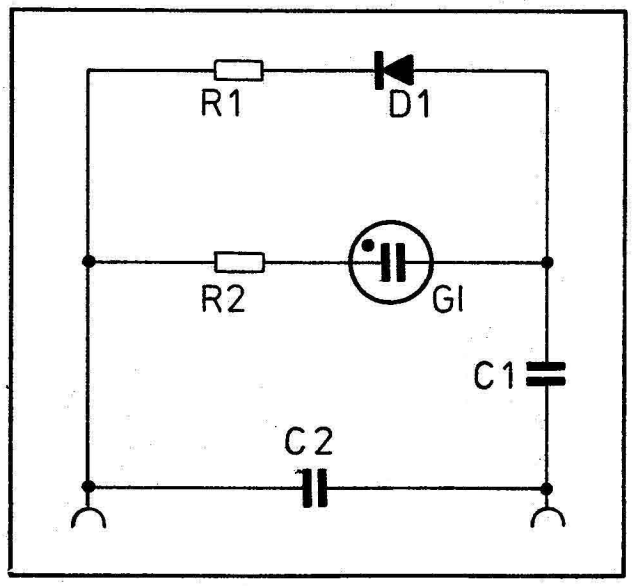


Fig. 8 Circuit board (output stages)

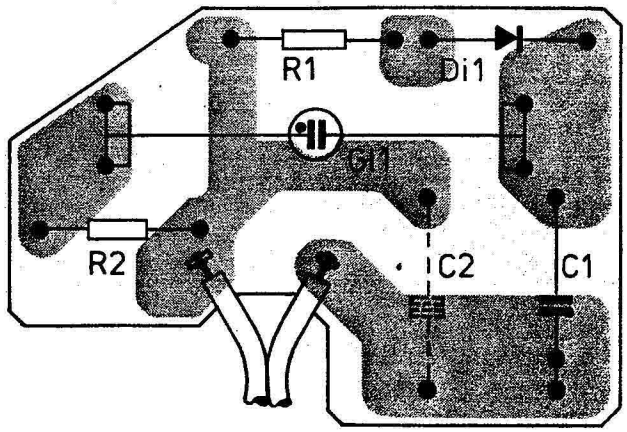
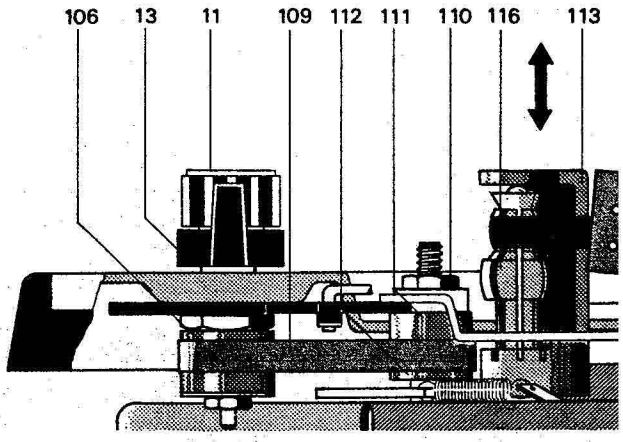


Fig. 9



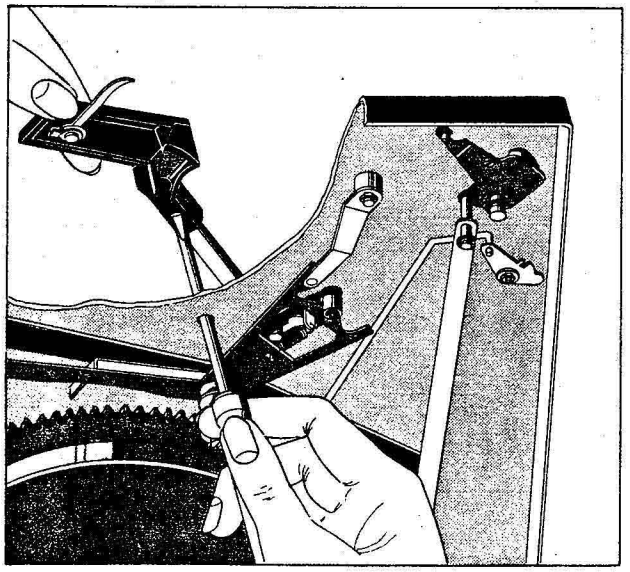
Pitch Control

The unit has a separately adjustable pitch control by which the two standard speeds 33 1/3 and 45 rpm can be varied by approximately 6 % (1 semitone).

By turning the fine speed adjustment knob (11) the toothed belt (Fig. 7) thus moving the counter bearing (113) upwards or downwards. The taper bush of the drive pulley (116) is designed to vary the diameter of the drive pulley (116) thus varying the nominal speed within the tolerance of + 3 %.

Trouble	Cause	Remedy
Nominal speed is at the edge of the control range of the pitch control.	Position of toothed belt pulley inaccurate.	By turning fine speed adjustment knob (11) move stop disk (111) to its center position (The dog of the stop disk should face the center of the drive pulley). Using adjustin nut (110) adjust for nominal speed. The nominal speed is increased by turning the adjusting nut (110) clockwise and decreased by turning the set screw counterclockwise.
Platter does not run after the line voltage cord of the unit has been plugged into the receptacle and the master operating switch moved to "start".	a) Power supply to motor interrupted b) Drive pulley slackened	a) Check connection at switch plate and power supply plug. b) Retighten drive pulley
Platter does not come up to its required speed.	a) Drive pulley is not correct for local line frequency	a) Renew drive pulley
	b) Slippage between flat belt and drive pulley or between flat belt and flywheel rotor	b) Clean friction surfaces of flat belt drive pulley and flywheel rotor. Renew flat belt if necessary. Once the flywheel rotor has been cleaned do not touch it with your fingers.
	c) Excessive friction in motor bearing or flywheel rotor bearing assembly	c) Clean and oil bearings

Fig. 10



Trouble	Cause	Remedy
Pick-up head not parallel to platter.	The pick-up head has been moved out of position on the tonearm tube during transport.	Remove platter. Using a screwdriver slacken screw on the pick-up head through the hole provided for this purpose in the chassis plate. After aligning the pick-up head retighten screw (Fig. 10).

Tonearm and Tonearm Bearing

The Dual 1249 has a feather-light, extremely torsion-resistant all-metal tonearm which is suspended in a gimbal. Suspension is by means of 4 hardened and precision polished steel points which rest in precision ball bearings. Tonearm bearing friction is thus reduced to a minimum.

Bearing friction vertical ≦ 0,07 mN (0,007 p)
Bearing friction horizontal ≦ 0,16 mN (0,016 p)
related to stylus point.

As a result, it ensures extremely favourable pick-up conditions. The pick-up head is removable. Before adjusting the pick-up force to suit the built-in pick-up cartridge the tonearm is balanced with the scale set to 0. Coarse adjustment is carried out by moving the counterweight (70) with stem, the subsequent fine adjustment by turning the preset disk of the counterweight. The balance weight is designed so that pick-up cartridges with a deadweight of 4,5 - 10 g can be balanced. For the absorption of vibration and rapid small shocks the counterweight is flexibly connected to its threaded stem.
The pick-up head is suitable for accommodating all pick-up cartridges whose type of mounting conforms with the international standard 1/2 inch mounting and whose deadweight does not exceed 10 g. The tracking force is adjusted by turning the graduated spring housing (78) and thus tensioning or releasing the coil spring mounted inside. The scale has markings from 0 - 30 mN (0 - 3 p) to define the range of adjustment. An exact setting is possible from 2 - 15 mN (0,2 - 1,5 p) for the required tracking force of 1 mN (0,1 p), for the range of setting of 15 - 30 mN (1,5 - 3 p), from 2,5 mN (0,25 p) to 2,5 mN (0,25 p).
To change the tonearm complete with tonearm suspension we recommend preceeding as follows:

1. Secure unit in repair jig and arrest tonearm.
2. Move unit into head position and unsolder tonearm leads.
3. Remove main lever (194).
4. Unhinge tension spring (239), loosen lock washer (245) and remove skating lever complete (248).
5. Remove lock washer (188) and sliding washer (187). Take off shut-off bar (182) from segment (240).
6. Remove lock washer (251, unhinge tension spring (196). Turn setting screw (66) until pivot bearing (252) and slide bar (253) are released. Take off lock washer (259) and slide bar (253).
7. Remove machine screw (222) and curb (220). Take off lock washer (58) and segment (240).
8. Loosen machine screw (231) and unhinge leaf spring (232) of lift pin (51).
9. Place turntable in normal position. Set adjusting curve (63) to position "multi", turn frame (54) of tonearm bearing anti-clockwise till stop gauge. Remove tonearm with bearing.

To reinstall tonearm complete with bearing carry out mounting in reverse order.
Attention: Don't forget to install compression spring (61).

To remove the tonearm from the bearing rack (72) the tracking force scale should first be set to zero position after unsoldering the tonearm leads. Remove counterweight (70). Turn both setscrews (74) into tonearm till stop gauge.

Attention: Bayonet mounting!

Push tonearm backwards and take it out of bearing rack (72). Assembly in reverse order.

For adjusting the tonearm head, a hole is provided in the chassis to make this possible without first removing the tonearm (Fig. 10).

Adjustment of Tonearm Bearing

Both bearings must have slight, just perceptible play. Adjustment of the vertical bearing should only be carried out by means of the left mounting screw (grub screw 55), that of the horizontal bearing by means of grub screw (52). The horizontal tonearm bearing is correctly adjusted when at antiskating setting "0.5" (tonearm previously balanced exactly) the tonearm slides in without resistance.

Fig. 11 Tonearm bearing assembly

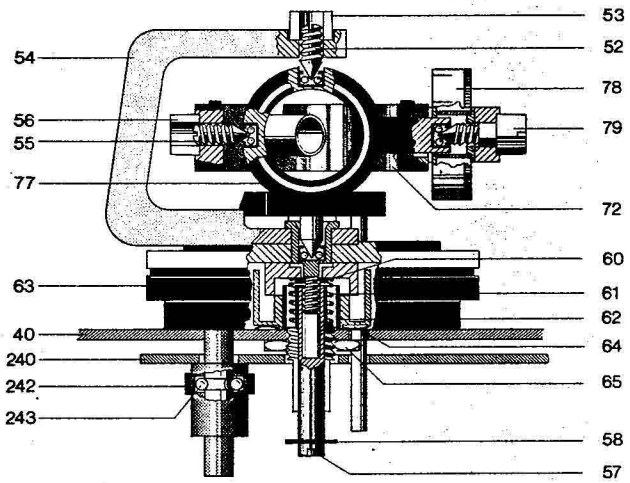


Fig. 12 Tonearm bearing assembly (view from underneath)

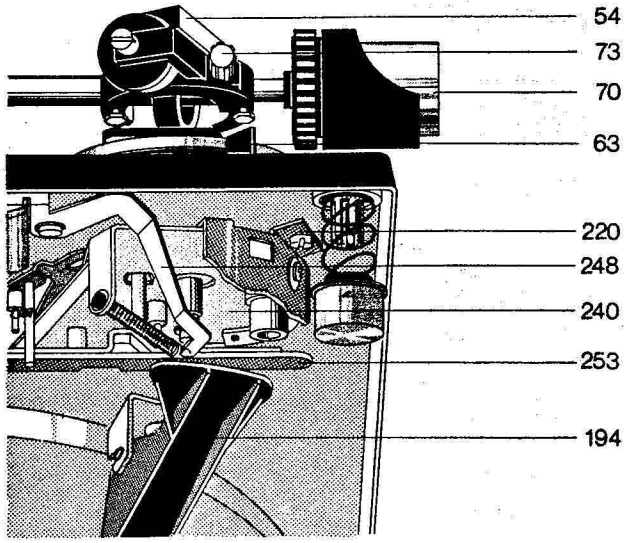
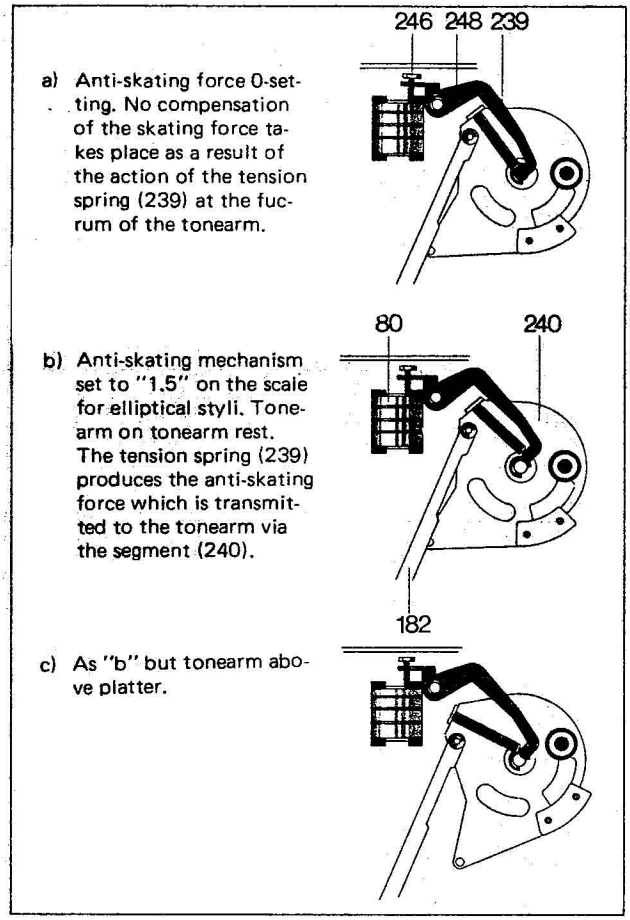


Fig. 13 Anti-skating force


246 248 239
a) Anti-skating force 0-setting. No compensation of the skating force takes place as a result of the action of the tension spring (239) at the fucrum of the tonearm.
80 240
b) Anti-skating mechanism set to "1.5" on the scale for elliptical styli. Tonearm on tonearm rest. The tension spring (239) produces the anti-skating force which is transmitted to the tonearm via the segment (240).
182
c) As "b" but tonearm above platter.

Anti-Skating Device

The geometrical skating force acting on every tonearm is eliminated on the Dual 1249 by means of a precision anti-skating device. The skating force is dependent on the geometry of the tonearm, on the tracking force and on the tip curvature of the stylus of the pick-up cartridge. The pull on the tonearm to the center of the platter caused by the skating effect leads not only to troublesome jumping of the tonearm when lowered manually or automatically, but also the uneven flank loading of the sound groove with the resultant effects which have to be eliminated on a hifi record player with the aid of the anti-skating device.

By turning the skating roller fitted on the mounting plate the asymmetrical curve track is moved. Depending on the different scales in operation provided for spherical and elliptical needles as well as for CD 4 cartridges, the skating lever (248) is moved from its rest position and by means of a tension spring (239) the equivalence is transmitted to the tonearm.

Optimum adjustment is carried out at the works for styli with a tip radius of 15 ± 2 µm (conical) and 5/6 x 18/22 µm (elliptical) as well as for CD 4 pick-up cartridges. The hexagon nut (226) is tightened and locked with paint. Alteration can only be carried out with the aid of the Dual Skate-O-Meter and test record L 096 and should only be done by an authorised service station.

Trouble	Cause	Remedy
Stylus slips out of playing groove	a) Tonearm is not balanced	a) Balance tonearm
	b) Tonearm tracking force is too low	b) Check tonearm balance, adjust tracking force to the value stated by the cartridge manufacturer
	c) Anti-skating setting incorrect	c) Correct anti-skating setting
	d) Stylus tip worn or chipped	d) Renew stylus
	e) Excessive bearing friction in tonearm bearing	e) Check tonearm bearings. Both bearings must have slight, just perceptible play. The adjustment of the vertical bearing should only be carried out with the left-hand bearing screw (grub screw 61), that of the horizontal bearing by means of grub screw (36). The horizontal bearing is correctly adjusted when at anti-skating setting "0.5" (tonearm previously balanced exactly) the tonearm slides in without resistance.
	f) Steel ball (183) of shut-off bar missing	f) Renew steel ball (183)
Vertical tonearm movement shows resistance during set-down	a) Bearing friction excessive	a) Eliminate friction by adjusting the bearing screw (grub screw 55) and check balance
	b) Lift pin (216) sticks in guide tube	b) Remove tonearm complete with bearing (see page 7). Unscrew drive shaft (57). Remove cover plate (49) from tonearm bearing. Remove guide (46) on lift pin (51). Remove lockwasher (47), detach adjuster sleeve (48) and remove second lockwasher (47). Withdraw lift pin evenly with "Wacker Silicone Oil AK 500 000". Reassemble components.

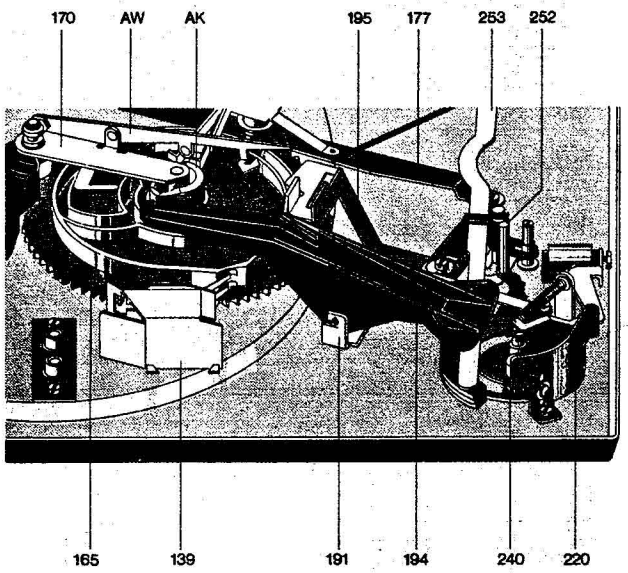
Tonearm Control

Automatic movement of the tonearm is initiated by the control cams on the inside of the cam wheel (165) on rotating through 360°.

The control elements fór raising and lowering are the control lever (194) and lift pin (51), for horizontal movement of the tonearm control lever (194) with segment (240).

The automatic tonearm set down is designed for 30 cm and 17 cm records and is coupled to the platter speed changeover. The set-down points of the tonearm are determined by the spring pin of segment (240) contacting the positioning slide (253). Limitation of the horizontal movement of the tonearm is produced by the pin of segment contacting the stop attached to the slide bar (253). Only during set-down does control lever (194) lift the slide bar (253) and the stop attached to it which, as a result, moves into the swivel range of the stop pin fitted on the segment. After completion of set down (lowering of the tonearm onto the record) the slide bar (253) position. As a result the stop moves out of the swivel range of the stop pin so that unimpeded horizontal movement of the tonearm is possible for playing.

Fig. 14 Tonearm guide mechanism



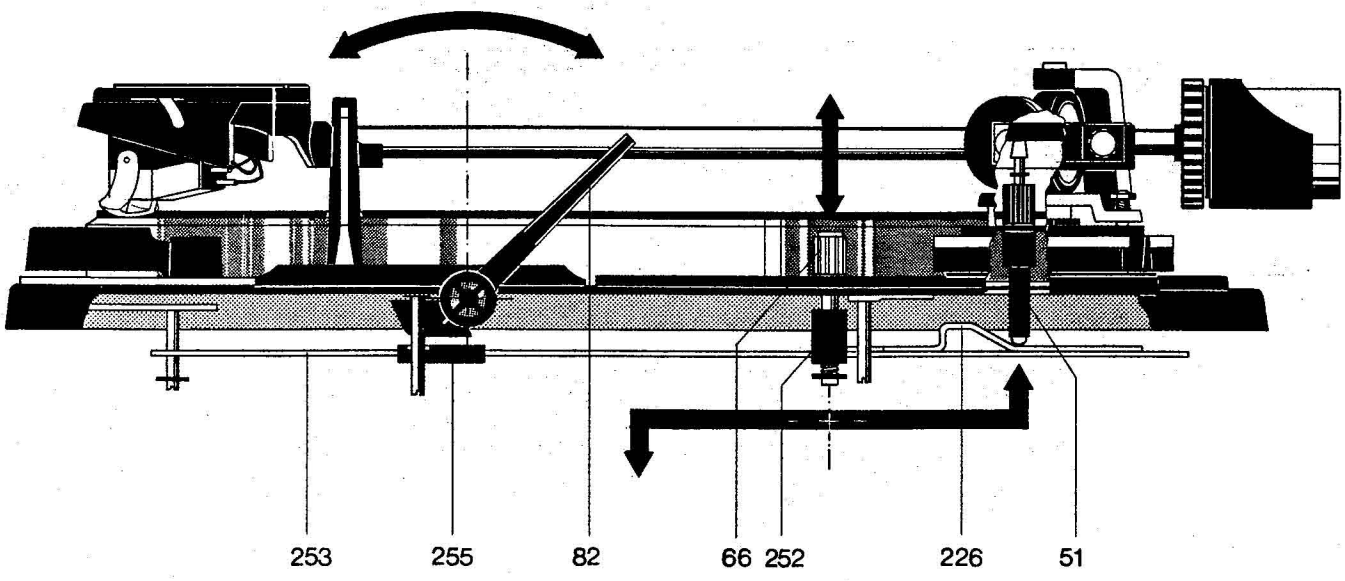
Cue Control

The cue control permits gentle set-down of the tonearm at any desired point (outside the shut-off range) on the record.

By moving cueing lever (82) (moving forwards) lift cam rotates. The slide bar (253) connected to it transmits this movement to the lift pin which then raises the tonearm. After moving the tonearm into the required position on the record, cueing lever is released by gently moving to the rear. As a result, slide bar (253) is released and the tonearm lowers slowly. Lowering of the tonearm is damped by silicone oil in the lift tube.

The heigt of the stylus above the record can be varied by turning adjusting screw (66) within the range 0 - 6 mm. The distance is increased by turning clockwise and the distance between record and stylus can be reduced by turning anti-clockwise.

Fig. 15 Tonearm lift



Trouble	Cause	Remedy
Tonearm does not set down at the edge of the record	a) Tonearm set-down point is incorrectly set	a) Slightly lift Dual logo placed (87) at the left lower corner and move it outward. Through theopening an adjustment screw becomes accessible. **Adjustment of tonearm indexing for 30 cm record:** Move speed selector (13) to "45" and correct setting using a suitable screwdriver. If the stylus sets down too far inside the lead-in groove turn adjustment screw clockwise. If it sets down too far outside the lead-in groove turn adjustment screw counterclockwise. **Adjustment of tonearm indexing for 17 cm record:** Move speed selector (13) to "45" and correct setting using a suitable screwdriver. If the stylus sets down too far inside the lead-in groove turn adjustment screw clockwise. If it sets down too far outside the lead-in groove turn adjustment screw counterclockwise.
	b) Record non-standard	b) Use standard record
	c) Friction face of tonearm coupling dirty	c) Clean friction surfaces
	d) Anti-skating setting is incorrectly set	d) Correct anti-skating setting
Tonearm does not set down on record after operating cue control	Excessive damping in the lift tube as a result of contamination of the silicone oil.	Remove tonearm complete with bearing (see page 7). Unscrew drive shaft (57). Remove cover plate (49) from tonearm bearing. Detach control stud on the lift pin, remove safety washer (47), detach adjusting sleeve and second washer (48). Withdraw lift pin (51), clean lift pin and lift tube. Smear lift pin evenly with "Wacker Silicone Oil AK 500 000". Reassemble components. Wipe off surplus silicone oil after assembly.
Tonearm lowers onto record too quickly when cue control is operated.	Damping insufficient as a result of unsuitable addition of lubricant to damping compound.	Remove tonearm complete with bearing (see page 7). Unscrew drive shaft (57). Remove cover plate (49) from tonearm bearing. Detach control stud on the lift pin, remove lockwasher (47), detach adjusting sleeve and second washer (48). Withdraw lift pin (51), clean lift pin and lift tube. Smear lift pin evenly with "Wacker Silicone Oil AK 500 000". Reassemble components. Wipe off surplus silicone oil after assembly.
Tonearm returns to rest after manual set-down immediately after the platter starts to turn.	Position of shut-off has altered during transport of the unit	After fitment and each time after transport the unit should be started once with tonearm secured for automatic adjustment of automatic shut-off (control lever (86) to "Start").

Starting

When the control lever (86) is moved to position "start" the starting lever (211) is turned outwards. The following operations are started:

a) the starting lever actuates the gear shifting gate (210) pivoted on the grooved pin. (205). At the same moment the mains switch (153) is operated and the turntable platter (34) and motor 132) are rotating.

b) The shifting gate (210) is moved in direction to the cam follower lever (168), it is then moved to starting position when the cam wheel is turning.

c) The actuation of the control lever (86) releases the start lever (206) which is moved towards the cam wheel by means of a tension spring (207). Then the shut-off lever is moved towards the striker near the pinion of the driving disk and then the cam wheel is running.

Manual Start

The pawl (198) coupled to control arm (177) engages behind the square end attached to the chassis when the tonearm is moved inwards by hand and retains the control arm in this position.

The power switch is operated by the shut-off lever (179) coupled to the control arm and thus the motor and platter starts to rotate. After reaching the run-out groove of the record return of the tonearm and shut-off of the unit take place automatically.

If, on the other hand, the tonearm is lifted off the record before playing is completed and is moved onto the rest by hand, the pin of the segment (240) disengages the pawl (198) so that the control arm is returned to its starting position. As a result, the power switch shuts off the power supply.

Short Circuiter

To prevent disturbing noises during automatic operation of the tonearm the unit is fitted with a short circuiter. Control of the switch springs for both channels is effected by the camwheel. With the unit in neutral state the short circuit of the pick-up leads is eliminated.

Continuous Play

Continuous play is operated by turning knob (84) to ∞ position. By turning the knob (84) the switching system (236) is moved, the starting lever (211) is actuated and then forcing the cam follower lever (168) to start position. After playing a record the tonearm is moved back and sets down on the run-in groove of the record. This operation is repeated - also in automatic mode, till the operation lever (86) is turned to "stop" or if the knob (84) is turned to position "1".

Stopping

When control lever (86) is set to "stop" position the start lever (206) which is pulled towards the cam by means of tension (207), is freed. As a result, the shut-off lever (161) is moved into the range of dogs on the platter pinion thus driving the main cam. The cam follower lever (168) remains in its stop position.

Record Drop

Insert the appropriate spindle - AW 3 . standard records (7 mm or 1/4" center hole) or AS 12 for 45 rpm records (38 mm or 1 1/2" center hole).

To prevent faulty operation, automatic record-changing operation is possible only when the mode selector is in the "multi" position.

Record drop is initiated by the rotation of cam (165), whose cam surface (AK) guides the cam rocker (AW), pushing the change actuator stud (173) and releasing a record by means of the automatic spindle. The main cam is designed so that a record can drop only when the tonearm is above the tonearm rest and thus out of the reach of the largest possible record (12" diameter).

Fig. 16

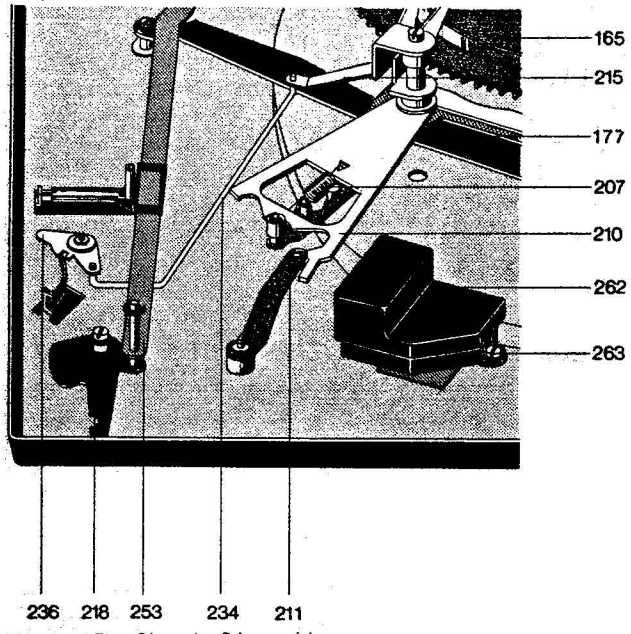


Fig. 17 Short Circuite

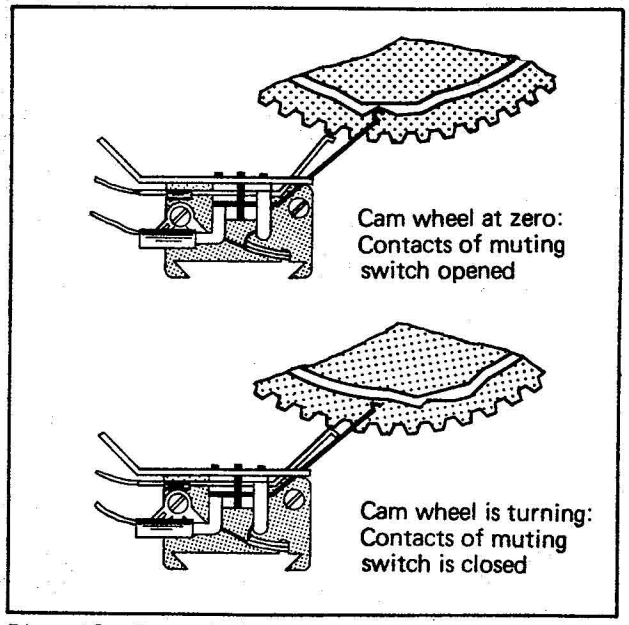


Fig. 13 Record drop

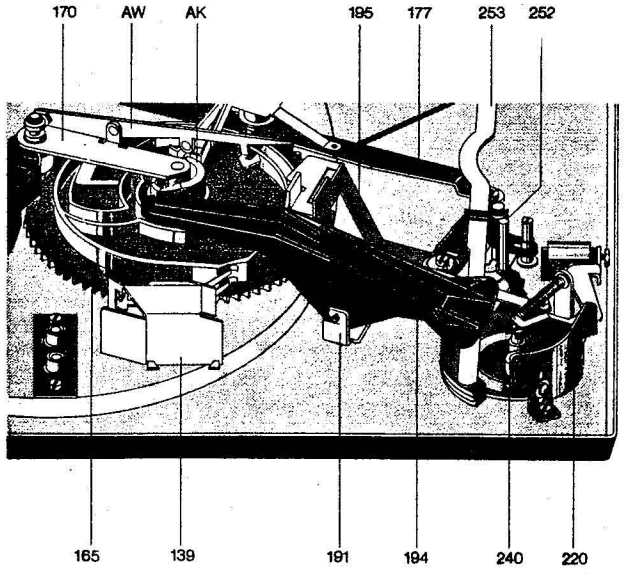


Fig. 19 Initiating shut-off function

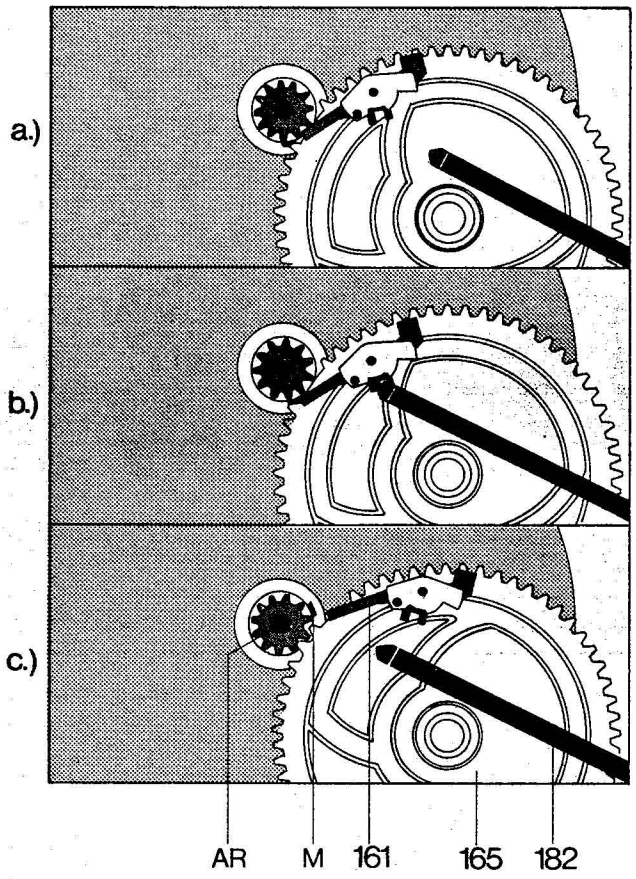


Fig. 20

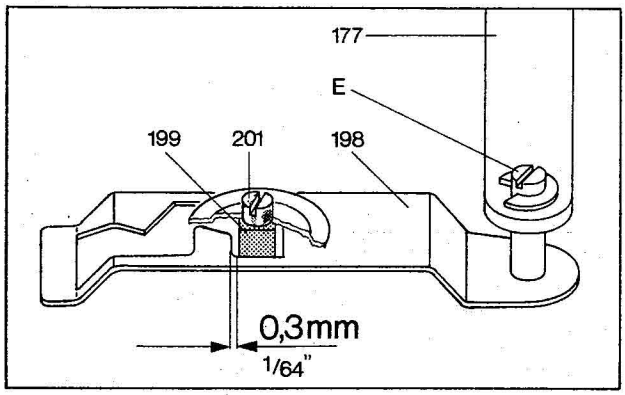
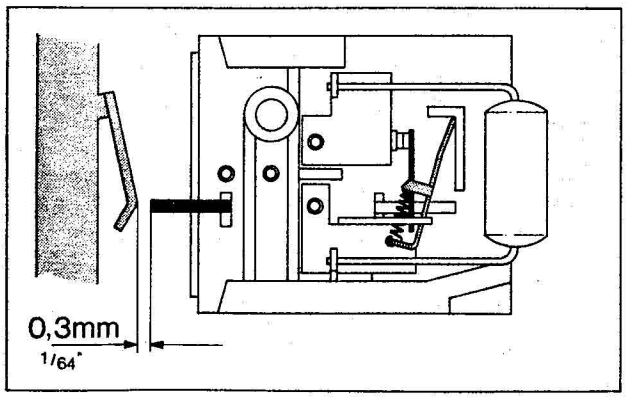


Fig. 21



Shut - off and Change Cycle

The dog (M) on the turntable platter gear (AR) and the shut-off lever (161) actuate both the change cycle at the end of the record as well as the shut-off after the last record in a stack is played.

At the end of a record, the tonearm moves towards the center at an accelerated rate due to the increased pitch of the grooves. This motion carries the shut-off lever (161) towards the dog by means of the shut-off slide (182). The eccentric dog pushes the shut-off lever (161) back at each revolution as long as the tonearm advance is only one normal record groove.

The run-out groove with its steeper pitch moves the shut-off lever against the dog with greater force, engaging the shut-off lever (161) and causing the main cam (165) to be driven out of its neutral position by the turntable platter gear.

Shut-off Mechanism

Shut-off and change functions are determined by the position of the cam follower lever (168). After every start or record drop, the cam follower lever is brought to its stop position by the main lever (194) (longer end towards the center of the main cam).

As the record is dropped the cam follower lever (168) is turned to its start position by the cam rocker (AW), so that the tonearm can swing in toward the record and be lowered on to it. If there are no more records on the spindle, and the cam rocker cannot turn the cam follower lever, the lever remains in its stop position and allows the tonearm to swing to its rest position.

When the main cam (165) returns to its neutral position, the switch arm (177) drops into a cut-out in the main cam, opening the power switch (153).

Trouble

Platter remains stationary after automatic set-down of tonearm on record

Cause

a) Shift arm (177) not locked by pawl (198).
b) Power switch has interrupted power supply (has switched off).

Remedy

a) Turn eccentric pin (E) on the pawl (Fig. 20)
b) Adjust shut-off lever (179) (Overrun of 0.3 mm between switch slide and shift/ arm).

Trouble

Last record of stack keeps repeating

Cause

Defective spindle

Remedy

Replace spindle

Trouble

Records do not drop

Cause

Cam rocker has too little travel

Remedy

Adjust eccentric (E) so that when the three supports in the automatic spindle are held in and the main cam is at neutral, pressing the change screw moves the support about 0.2 mm (1/64").

Trouble

Horizontal tonearm movement shows resistance during set-down.

Cause

Adjustment sleeve (48) or set screw (75) out of adjustment.

Remedy

Regulating curve (63) in position "multi" Rotate cam (165) from its neutral position until main lever (194) lifts the tonearm completely.

Turn adjusting sleeve (48) so that the bottom edge of the cartridge head is 7 mm above the top edge of the tonearm rest, the tonearm being unlocked. Then, turn set screw (75) so that there is a play of approximately 0.1 mm between stud and contact face of tonearm (measured at tonearm head approx. 0.5 mm). (Fig. 23).

Fig. 22

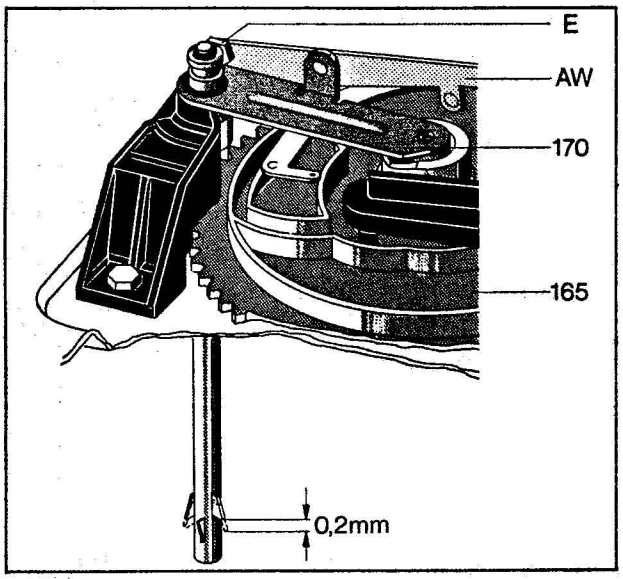
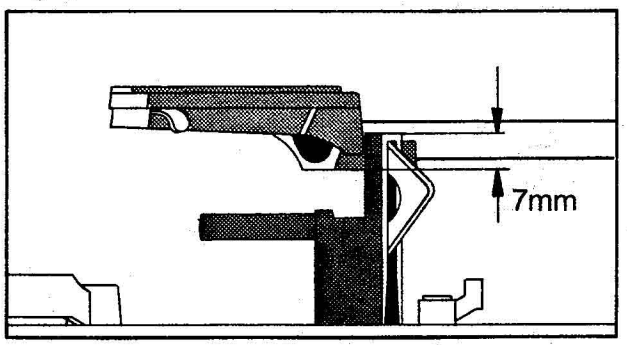


Fig. 23



Trouble	Cause	Remedy
Tonearm moves with tracking force and anti-skating scale in 0 position a) outwards b) inwards	a) Anti-skating device out of adjustment b) Excessively tight tonearm leads produce a torque	a) Adjust skating lever so that skating spring acts exactly at the tonearm pivot b) Loosen tonearm leads.
During automatic operation of tonearm disturbing noises are perceptible.	Short circuiter out of adjustment. The distances between the slide springs and the short circuit strips on the short circuiter are excessive.	By bending the short circuiter strips. Adjustment is correct when, with the camwheel in neutral position, the distance between the slide springs and the short circuit strips on the short circuiter is approximately 0.5 mm. Spray contact springs with preservative (e.g. Kontakt 61) and check adjustment of short circuit strips.
No reproduction. The short circuit of the pick-up leads is no longer being eliminated.	Distance between the slide springs and the short circuit strips on the short circuiter is absent or insufficient.	By adjusting the short circuit strips. Adjustment is correct when, with the camwheel in neutral position, the distance between the slide springs and the short circuit strips on the short circuiter is approximately 0.5 mm.
Motor does not shut off when tonearm sets down on rest.	Suppression capacitor (in power switch) is defective (short circuit).	Replace suppression capacitor in power switch with new component.
Acoustic feedback	a) Chassis components (e.g. also connecting leads) are rubbing on cutout. b) Connecting leads are too tight.	a) Line up cutout according to instructions supplied with unit. Move leads. b) Slacken or lengthen cable
Records do not drop with changer spindle in place	Mode selector is set to "single"	This is normal

Replacement Parts above Chassis

Pos.	Part.-No.	Description	Qty.	
1	215 470	Automatic spindle AS 12	1	
2	213 895	Automatic spindle AW 3	1	
3	220 213	Centering piece	1	
4	201 101	Centering pin	1	
5	234 428	Support assembly	1	
6	210 472	Machine screw AM 3 x 4	6	
7	232 086	Tension spring	1	
8	234 430	Locking bar compl.	1	
9	232 087	Tension spring	1	
10	210 194	"C" clip 2/6	1	
11	234 682	Adjustment knob	1	
12	232 078	Bearing bush	1	
13	234 681	Speed selector	1	
14	236 892	Speed control blind	1	
15	213 260	Pin 2 x 6	8	
16	214 210	Shipping screw compl.	3	
17	210 624	Washer 4.3/7/0.3	6	
18	200 718	Compression spring	3	
19	210 624	Washer 4.3/7/0.3	6	
20	201 632	Rubber washer	3	
21	200 713	Washer	3	
22	200 712	Spring cup	3	
23	200 711	Lock washer	3	
24	214 047	Special screw	3	
25	232 435	Washer	1	
26	236 893	Platter mat compl.	1	
27	236 896	Contact plate compl.	1	
28	234 611	Handle	1	
29	210 182	Bowed lockwasher 4.2/8	1	
30	210 630	Washer 4.2/8/0.5 St	1	
31	210 197	"C" clip 4/0.8	1	
32	236 894	Tonearm head compl.	1	
33	200 543	Retaining ring	1	
34	236 897	Platter compl. with mat	1	
35	236 898	Flywheel rotor assembly	1	
36	234 435	Flat belt	1	
37	236 242	TK 24 cartridge mount	1	
38	210 472	Machine screw AM 3 x 4	6	
39	234 599	Reset cum	1	
40	236 899	Chassis compl.	1	
41	230 529	Threaded piece	4	
42	232 842	Compression spring (Motor side back)	1	
	236 017	Compression spring red (Motor side front)	1	
	232 843	Compression spring (Tonearm side)	2	
43	234 432	Spring mount compl. (Motor side back)	1	
	236 401	Spring mount compl. (Motor side front)	1	
	234 433	Spring mount compl. (Tonearm Motor side)	2	
44	200 723	Rubber damping block	4	
45	200 722	Steel cup	4	
46	216 844	Guide	1	
47	210 143	Lock washer 1.5	3	
48	218 318	Adjusting sleeve	1	
49	236 900	Cover plate	1	
50	216 853	Compression spring	1	
51	234 645	Lift pin	1	
52	234 651	Grub screw	1	
53	234 635	Lock nut	2	
54	236 901	Frame compl.	1	
55	234 634	Grub screw	1	
56	234 635	Lock nut	2	
57	234 650	Bearing axle	1	
58	210 147	Lock washer 4	2	
59	234 649	Lifting piece	1	
60	210 586	Washer 3.2/7/ 1 St	3	
61	218 827	Campression spring	1	
62	216 810	Bearing for tonearm	1	
63	234 604	Operating curve	1	
64	227 027	Spring washer	1	
65	218 321	Hex nut M 10	1	
66	234 667	Locating screw for pin	1	
67	234 522	V spring	1	
68	236 902	Rear cover compl.	1	
69	236 903	Tonearm compl.	1	
70	236 904	Weight compl.	1	
71	234 636	Needle	1	
72	236 905	Bearing rock	1	
73	234 619	Clamp bolt	1	

Fig. 24 Exploded view, parts above chassis

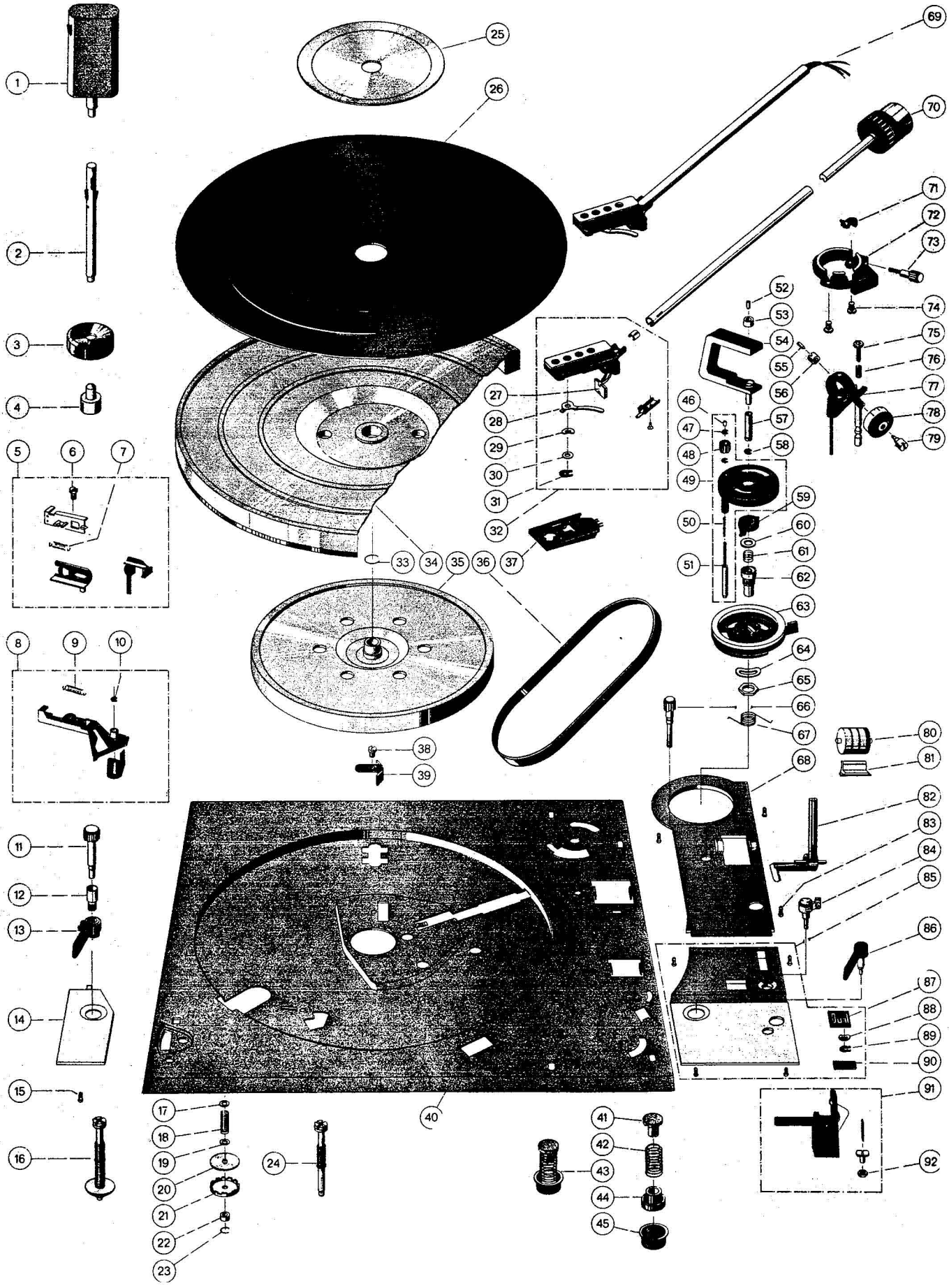
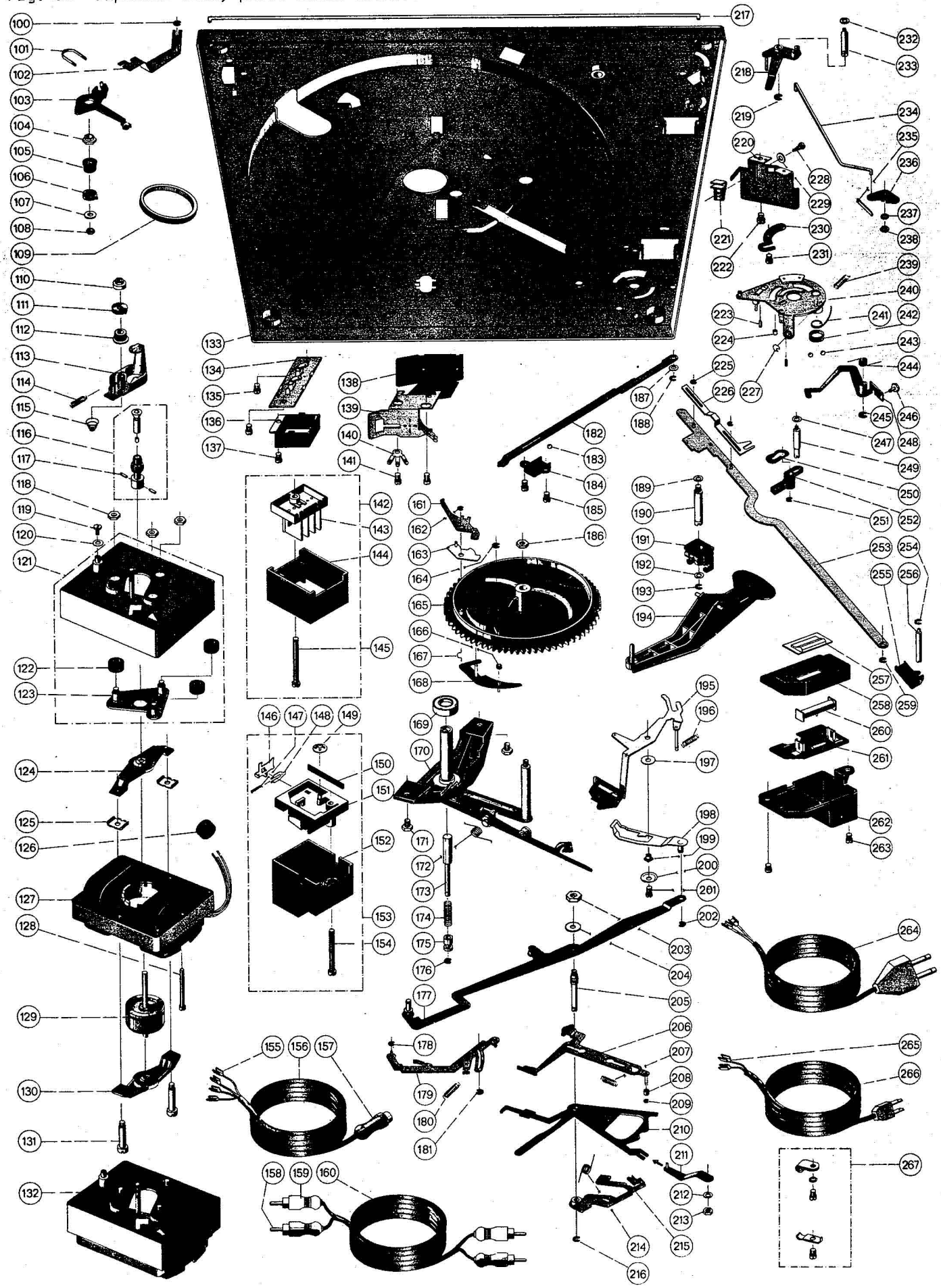


Fig. 25 Exploded view, parts below chassis



Pos.	Part.-No.	Description	Qty.	
74	234 617	Fastening screw	2	
75	234 633	Set screw	1	
76	232 068	Compression spring	1	
77	236 906	Bearing compl.	1	
78	236 907	Spring housing compl.	1	
79	234 637	Mounting screw	1	
80	236 908	Skating roller	1	
81	234 526	Skating indication	1	
82	236 909	Cueing lever	1	
83	213 260	Pin 2 x 6	8	
84	234 595	Knob (Continuous play)	1	
85	236 910	Cover front compl.	1	
86	234 586	Control lever	1	
87	234 533	Dual emblem	1	
88	218 894	Bowed lock washer 3.2/8	1	
89	210 196	"C" clip 3/6	1	
90	234 532	Label 1249	1	
91	236 911	Tonearm rest compl.	1	
92	210 362	Hex nut BM 3	5	

Replacement Parts below Chassis

Pos.	Part.-No.	Description	Qty.	
100	210 145	Lock washer 2.3	8	
101	232 071	Yoke spring	1	
102	232 096	Switch lever compl.	1	
103	232 094	Connecting part	1	
104	232 079	Joining nut	1	
105	232 097	Toothed belt pulley II	1	
106	232 049	Stop disk	2	
107	210 607	Washer 3.2/10/0.5	2	
108	210 362	Hex nut BM 3	5	
109	232 076	Toothed belt	1	
110	232 099	Adjusting nut	1	
111	232 049	Stop disk	2	
112	232 098	Toothed beltpulley I	1	
113	232 137	Counter bearing compl.	1	
114	233 777	Tension spring	1	
115	232 615	Campression spring	1	
116	234 453	Motor pulley 50 Hz compl. with conical sleeve	1	
	234 454	Motor pulley 60 Hz compl. with conical sleeve	1	
117	233 137	Set screw M 2.5 x 3	2	
118	210 366	Hex nut BM 4	3	
119	210 480	Machine screw AM 3 x 6	1	
120	210 609	Washer 3.2/10/1 St	1	
121	232 856	Shield compl. with inlayer	1	
122	232 841	Rubber damping block	3	
123	232 840	Inlayer compl.	1	
124	234 447	Top bearing compl.	1	
125	232 855	Spacer	2	
126	209 939	Cable grommet	1	
127	234 449	Stator 110/220 V compl.	1	
128	233 815	Machine screw AM 2.5 x 18	1	
129	234 450	Armature compl.	1	
130	234 451	Bottom bearing bracket compl.	1	
131	232 851	Centering screw	2	
132	234 452	8-pole Motor SM 840 compl.	1	
133	236 899	Chassis compl.	1	
134	227 254	Cynch socket plate	1	
135	210 469	Machine screw AM 3 x 3	6	
136	236 195	Screen plate compl.	1	
137	210 469	Machine screw AM 3 x 3	6	
138	232 084	Shield	1	
139	232 987	Short circuiter	1	
140	211 614	Soldering lug	1	
141	210 472	Machine screw AM 3 x 4	6	
142	233 005	Connection plate compl. with cover	1	
143	233 007	Connection plate compl.	1	
144	233 006	Connection plate cover compl.	1	
145	210 501	Machine screw M 3 x 35	1	
146	230 148	Switch slide	1	

Pos.	Part.-No.	Description	Qty.	
147	230 296	Tension spring	1	
148	219 200	Snap spring	1	
149	200 444	Spring washer	1	
150	236 335	Slide	1	
151	233 012	Switch plate compl.	1	
	233 013	Switch plate compl. w. special capacitor	1	
152	233 011	Cover compl.	1	
153	234 816	Mains switch compl.	1	
	233 008	Mains switch compl. w. special capacitor	1	
154	210 498	Machine screw M 3 x 28	1	
155	209 436	Flat connector sleeve	2	
156	207 303	Pick-up lead compl. with miniature play and flat connector	1	
157	209 424	Miniature play for audio cable	1	
158	209 425	Cynch plug white	2	
159	209 426	Cynch plug black	2	
160	226 817	Pick up lead compl. with Cynch plug	1	
161	234 568	Shut-off lever	1	
162	210 145	Lock washer 2.3	8	
163	234 566	Friction plate compl.	1	
164	210 144	Lock washer 1.9	2	
165	236 912	Camwheel compl.	1	
166	200 650	Rubber sleeve	1	
167	200 522	Snap spring	1	
168	234 562	Cam follower lever	1	
169	229 754	Ball bearing compl.	1	
170	236 913	Bearing support, compl.	1	
171	218 155	Hexagon screw M 4 x 6	2	
172	234 576	V spring	1	
173	234 577	Change bolt	1	
174	213 920	Compression spring	1	
175	213 921	Bushing	1	
176	210 145	Lock washer 2.3	8	
177	234 542	Shift arm	1	
178	210 144	Lock washer 1.9	2	
179	234 579	Shut-off lever	1	
180	234 582	Tension spring	1	
181	210 145	Lock washer 2.3	8	
182	234 668	Shut-off bar	1	
183	211 718	Steel Ball 3	1	
184	234 558	Ball bearing (bed)	1	
185	210 472	Machine screw AM 3 x 4	6	
186	210 366	Hex nut BM 4	1	
187	201 187	Sliding washer	1	
188	210 145	Lock washer 2.3	8	
189	210 587	Washer 3.2/7/1 St	2	
190	234 676	Bearing bolt	1	
191	234 677	Bearing support compl.	1	
192	210 667	Washer 5.3/10/0.5 St	1	
193	210 147	Lock washer	2	
194	236 914	Control lever compl.	1	
195	234 600	Reject lever compl.	1	
196	227 045	Tension spring	1	
197	222 279	Washer 4.2/10/0.3 St	1	
198	232 599	Pawl compl.	1	
199	234 603	Square section	1	
200	229 704	Washer	1	
201	227 060	Threaded bolt	1	
202	210 146	Lock washer	4	
203	210 362	Hex nut BM 3	5	
204	210 586	Washer 3.2/7/0.5 St	4	
205	234 544	Grooved pin	1	
206	234 545	Start lever	1	
207	229 698	Tension spring	1	
208	234 548	Turn on roller	1	
209	210 143	Lock washer 1.5	3	
210	234 550	Gear shifting gate	1	
211	234 583	Starting lever	1	
212	210 641	Washer 4.2/10/1 St	1	
213	210 362	Hex nut BM 3	5	
214	236 095	V spring	1	
215	234 555	Change lever	1	
216	210 146	Lock washer 3.2	4	
217	234 592	Linking lever	1	
218	234 588	Setting lever	1	
219	210 146	Lock washer 3.2	4	
220	236 689	Protective shield	1	

Pos.	Part.-No.	Description	Qty.	
221	234 663	Guide block	1	
222	210 472	Machine screw AM 3 x 4	6	
223	234 026	Set screw M 2.5 x 4	2	
224	223 777	Guide	1	
225	210 145	Lock washer 2.3	8	
226	234 673	Distance track	1	
227	201 184	Adjusting washer	1	
228	210 283	Fillister head screw B 2.9 x 6.5	1	
229	210 607	Washer 3.2/10/0.5 St	1	
230	234 664	Lap joint	1	
231	210 472	Machine screw AM 3 x 4	6	
232	210 587	Washer 2.2/7/1	2	
233	230 087	Screw bolt	1	
234	234 598	Connecting bus	1	
235	232 545	Leaf spring	1	
236	234 593	Guide angle	1	
237	203 477	Washer 2.7/8/1 St	1	
238	210 353	Hex nut BM 2	1	
239	218 591	Tension spring	1	
240	236 915	Segment	1	
241	234 658	Hook spring	1	
242	216 845	Rubber washer	1	
243	211 718	Steel Ball 3	3	
244	229 688	V spring	1	
245	210 146	Lock washer 3.2	4	
246	230 456	Adjusting screw	1	
247	210 586	Washer 3.2/7/0.5 St	4	
248	234 549	Skating lever compl.	1	
249	234 665	Screw bolt	1	
250	223 146	Fuse spring	1	
251	210 145	Lock washer 2.3	8	
252	229 362	Guide bearings	1	
253	234 670	Slide bar	1	
254	210 145	Lock washer 2.3	8	
255	234 674	Brake section	1	
256	234 669	Screw bolt for bruke section	1	
257	234 700	Strobe diaphragm	1	
258	236 916	Stroboscope housing	1	
259	210 146	Lock washer 3.2	4	
260	225 321	Glow lamp	1	
261	236 917	Wiring board compl.	1	
C 1	225 322	Foil capacitor 68 nF/400 V/10 %	1	
C 2	224 886	Foil capacitor 47 nF/250 V/20 %	1	
D 1	225 247	Silicon diode BY 183/300	1	
R 1	232 402	Film resistor 22 kΩ/0.25 W/5 %	1	
R 2	232 401	Film resistor 12 kΩ/0.125 W/5 %	1	
262	236 918 -	Cover (housing top) compl.	1	
263	210 469	Machine screw AM 3 x 3	6	
264	232 996	Power cable Europe compl.	1	
265	214 602	AMP connector	2	
266	232 995	Power cable US compl.	1	
267	231 079	Cable clips compl.	1	
***	214 120	Hardware for cartridge mounting	1	
***	229 321	Packing carton 1249 compl.	1	
***	236 920	Packing carton CS 1249 compl.	1	
***	236 328	Mounting instructions	1	
***	236 434	Operating instructions	1	
***	236 257	Operating instructions UAP	1	

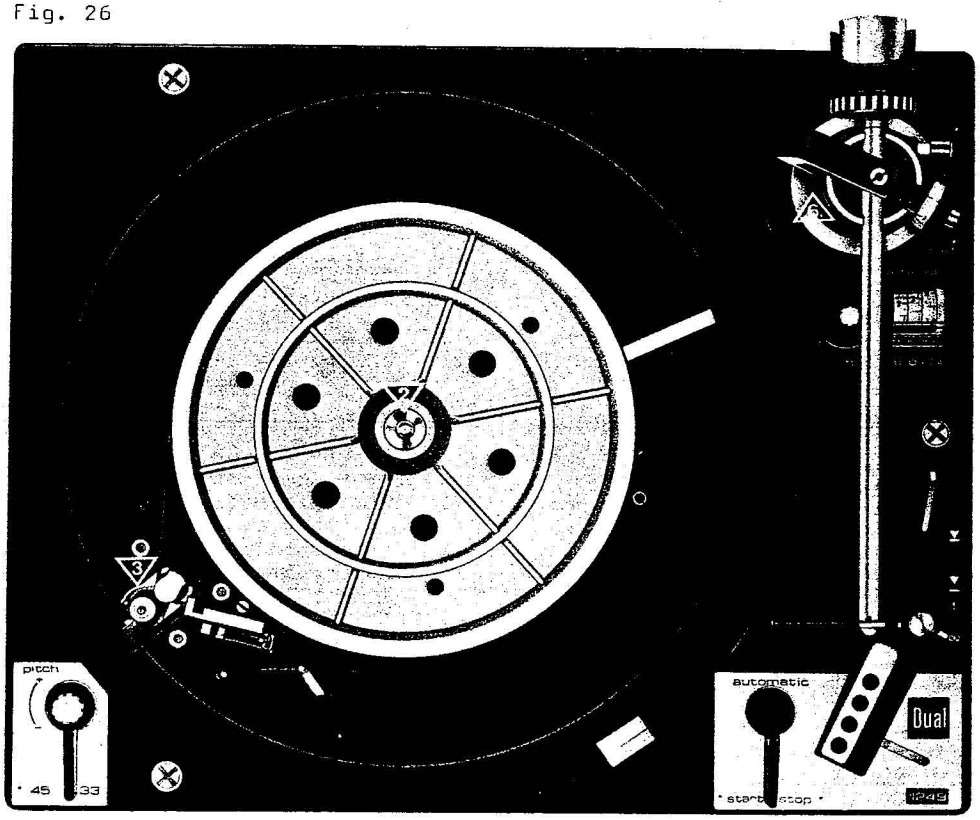
*** Not illustrated

Alterations reserved

Lubrication

All bearing and friction points of the unit are adequately lubricated at the works. Replenishment of oil and grease is only necessary after approximately 2 years of normal use of the record player as the most important bearing points (motor bearings) have sintered metal bushes.
Bearing points and friction faces should be lubricated sparingly rather than generously.
It is important that no oil or grease should come in contact with the friction faces of the flat belt, drive pulley and flywheel rotor, otherwise slip will occur.
When using different lubricants, chemical decomposition can often take place. To prevent lubrication failure we recommend using the original lubricants stated below. The following lubricants should be used for subsequent lubrication:

Fig. 26



2 Renotac No. 342 adhesive oil

3 BP Super Viscostatic 10 W/30

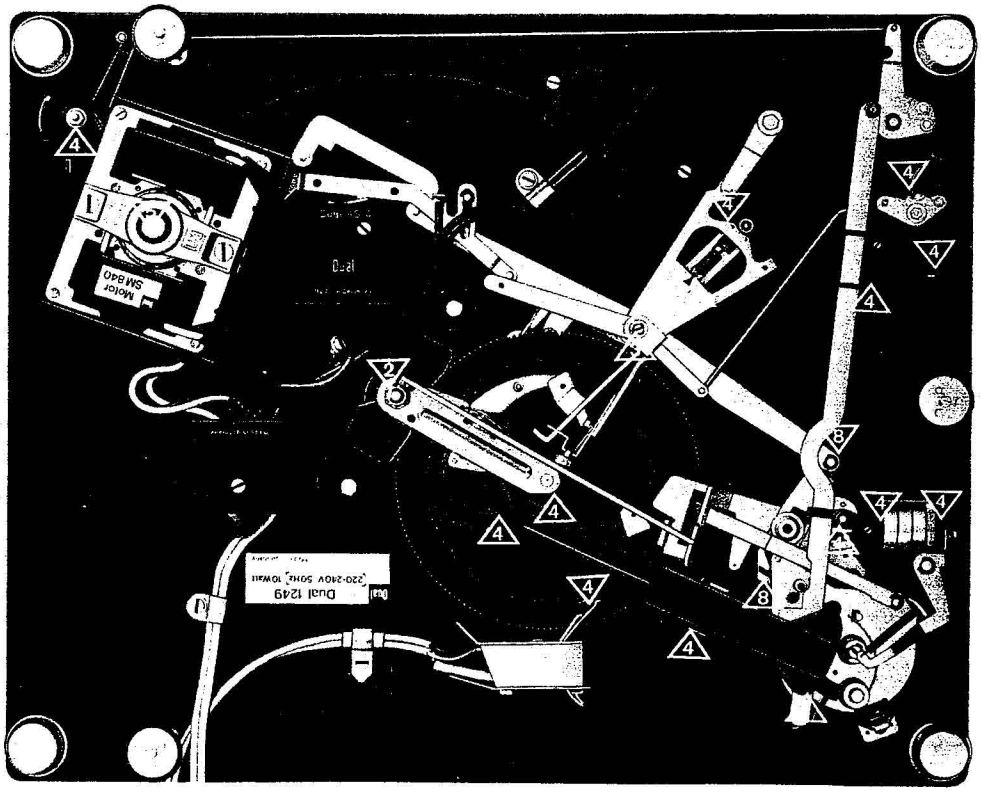
4 Shell Alvania No. 2

5 Isoflex PDP 40

6. Silicone oil AK 500 000

8 Molykote

Fig. 27



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